Antifriction bearings equipped with sensors

Field of the invention

The invention relates to antifriction bearings equipped with sensors, which are used in an extremely wide range of applications in order to measure the force acting on the antifriction bearings and the temperature.

Background of the invention

Antifriction bearings equipped with sensors have the task of measuring the operating conditions present on the antifriction bearing, in order then to be able to control or regulate the overall process of the machine arrangement by using this measured data. In this case, antifriction bearings equipped with sensors are used for force measurement, measurement of the direction of rotation, rotational speed measurement and temperature measurement. Such antifriction bearings equipped with sensors are also disclosed, inter alia, by US 5,952,587. The use of strain gage sensors, for example, and the evaluation of these measured results are extensively described in the text. The problem with this text is that, for antifriction bearings having a different number of antifriction elements, a different number of cables have to be led from the antifriction bearing to the evaluation unit located outside. The problem is therefore that the evaluation unit has to be designed differently,

depending on the antifriction elements currently used in the antifriction bearings.

Object of the invention

There is, therefore, the object of proposing an evaluation unit for anti-friction bearings equipped with sensors which can be used independently of the number of antifriction elements in the antifriction bearing.

Summary of the invention

This object is achieved by the features in the characterizing part of claim 1.

The essential core of the invention is that a standardized interface is introduced between antifriction bearing and evaluation unit. This standardized interface makes it possible always to provide the same information at the interface, irrespective of the number of antifriction elements in the antifriction bearing. This is achieved by the antifriction bearing being subdivided, for example into three (claim 2) regions covering 120°. All the sensors which lie within a 120 degree region are evaluated by means of an ASIC disposed on the antifriction bearing, so that the result is a force vector in this region. In this case, a region ASIC carries out a vector addition of the individual vectors which are determined by the sensors, in order to form an overall vector. The force vectors from the three region ASICs are

therefore continuously present at the interface between the antifriction bearing and the evaluation unit. Each of the three ASICs therefore transmits an item of information which contains the magnitude of the force and the direction of the force in the respective region. In the evaluation unit, these three region vectors are then added vectorially and a vector which corresponds to the total loading of the antifriction bearing is thus determined.

According to claim 3, the antifriction bearing is divided up into 4 regions of 90 degrees. The difference as compared with claim 2 is that here 4 region ASICs are used, which determine the force vector (magnitude and direction). Otherwise, the further procedure corresponds to claim 2.

Description of the drawing

The invention is illustrated in a figure. The side view schematically shows an antifriction bearing comprising the outer ring 1, the inner ring 2 and the antifriction elements 3. Here, 9 antifriction elements are shown in the example. On the outer ring 1, sensors 4, 5 are disposed schematically. The sensors are disposed in a groove in the outer ring. The sensors 4, 5 are disposed in such a way that the sensor spacing corresponds to half the distance between two antifriction elements. In this illustration, the sensor 5 is currently situated directly in rolling contact, while the sensor 4 is situated precisely between two antifriction

elements. The sensors 4 and 5 constitute a strain gage half bridge 6, two further sensors, which are used for the temperature compensation of these two sensors 4 and 5, being disposed outside the loading zone of the antifriction bearing. Likewise disposed in the groove in the antifriction bearing is the region ASIC which adds up the results (from three antifriction elements in the drawing) for one region of 120 degrees. The current angular position in the 120 degree region (of the respective strain gage half bridge) is passed on to the region ASIC via the factors c1, c2 and c3 for region 1, and also c4, c5 and c6 for region 2 and c7, c8 and c9 for region 3. c1 to c9 are scalars which correspond to the angular position of the individual sensors in a region. The region ASICs then form the region vector 7, 8, 9 from the measured values. These region vectors (magnitude and direction) 7, 8, 9 are transmitted to the evaluation unit via a defined interface.

List of designations

1	Outer ring
2	Inner ring
3	Antifriction element
4	Unloaded sensor
5	Loaded sensor
6	Sensor or strain gage half bridge
7, 8, 9	Region vectors
c1...c9	Current angular position of the sensors or strain gage half bridges in the region